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Mechanisms of nanoparticles size reduction by laser irradiation ALEXANDER PYATENKO, MUNEHIRO YAMAGUCHI, MASAAKI SUZUKI, AIST — Size reduction of nanoparticles after laser irradiation is well known phenomenon. Two different mechanisms of size reduction have been proposed: 1) the photoejection of electrons from a particle into a solution which caused ionization and Coulomb explosion of the ionized particle. 2) a simple heating-melting-evaporation mechanism. In this report we show that the different mechanisms are working under different experimental conditions, and give the criterion for their applicability. The main experimental parameter responsible for such criterion is the laser energy flow density, $I_0 = E/\tau s$, where E and τ are the laser pulse energy and duration, and S is the laser beam cross section. We calculated the critical value for this parameter in case of spherical silver and gold particles. When this parameter exceeds the value of about 10^{10} W/cm^2, the electron ejection can be started. For nanosecond lasers such energy flow density values can be achieved only with beam focusing, but for pico and especially femto lasers this condition can be realized in different experimental arrangements. When I_0 is smaller than the critical value, the particle heating-melting-evaporation mechanism is responsible for particle size reduction.

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